Factors affecting Zn availability in Soil

1. Total Zn: Total Zn more, fixation will be more.

2. Soil pH: Soil pH is the most strongly influences the Zn availability in soils. The solubility of Zn decreases as soil pH increases.

According to Limdsay (1975), Zn availability decreases 10^6 for each unit rise in pH as soon in the equation-

$$Zn^{++} = 10^6\,[H^+]^2$$

▲ All micro nutrient except Mo available in low pH.

▲ Causes for lower Zn availability in higher Soil pH:

♦ Formation of insoluble $Zn(OH)_2$ and $ZnCO_3$ at higher pH.

$$Zn^{++} + H_2O \rightarrow Zn\,OH^+ + H^+$$

$$Zn\,OH^+ + H_2O \rightarrow Zn(OH)_2 + H^+$$

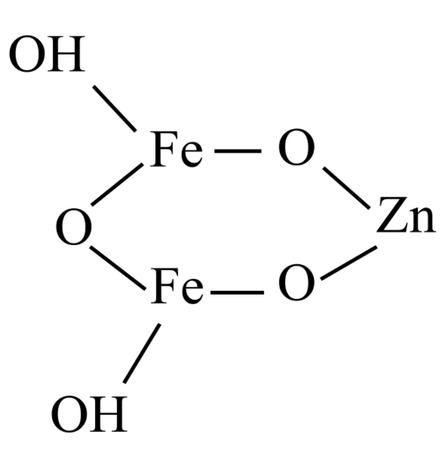
$$Zn^{++} + CaCO_3 \rightarrow ZnCO_3 + Ca^+$$

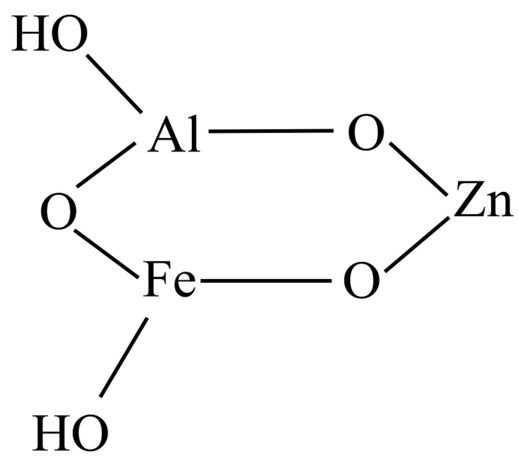
♦ Adsorption of Zn on the surface side of clay and organic matter.

$$\left.\right]OH + Zn^{++} \rightleftarrows \left.\right]O^-\,Zn^{++} + H^+$$

$$\left.\right]OH + Zn^{++} + H_2O \rightleftarrows \left.\right]O^-\,ZnOH^+ + 2H^+$$

♦ Adsorption of Zn by oxide of Fe and Al through oxygen linkage.





♦ Lesser competition of Zn^{++} with H^+ at higher pH.

$$Clay\left.\begin{matrix}H^+\\H^+\\H^+\\H^+\end{matrix}\right. + Zn^{++} \rightleftarrows Clay\left.\begin{matrix}Zn^{++}\\\\Zn^{++}\end{matrix}\right. + 4H^+$$

- ♦ Formation of Zn organic compound at higher pH.

3. Flooding: Increase pH in acid soil and decrease pH in alkaline soil due to the neutral value. Zn availability is low in flooded condition because-

- ♦ Formation of insoluble ZnS.

$$SO_4^{++} + H^+ \rightarrow H_2S$$

$$Zn^{2+} + H_2S \rightarrow ZnS \downarrow (ppt)$$

- ♦ Production of HCO_3^-, HCO_3^- hampers Zn uptake.
- ♦ Increases the availability of Fe, P and Al.

4. Zn availability is low in Calcareous soil. The reason are as follows:

- ♦ Formation of insoluble $ZnCO_3$.

$$Zn^{++} + CaCO_3 \rightarrow ZnCO_3 + Ca^{++}$$

- ♦ Adsorption of Zn^{++} on the surface of carbonates.
- ♦ Formation of insoluble Calcium Zincate ($CaZnO_2$).

5. Bi-carbonate Level: High HCO_3^- level in soil may inhibit Zn uptake by plants. The concentration of HCO_3^- ion may increase for higher decomposition of OM and irregular water supply.

6. Soil organic matter: Zn availability is generally low in the soil containing lower amount of OM.

7. Soil texture: Nutrients are easily leached down through sandy soil than clay soil.

8. Temperature: Zn availability is low in low soil temperature.

9. Interaction with other elements: High level of available P in soil may be responsible for Zn deficiency in soil. Other interaction such as Zn-N, Zn-P, Zn-S, Zn-Ca, Zn-Mn, Zn-Cu etc have also been reported to some workers.

10. Fertilizer application: Application of fertilizer may change soil pH then Zn availability will be affected.

11. Rhizosphere behaviour: Rhizosphere effects are known to be affect exudates, mucilage etc are clay micro interaction and root or microbial biomass. Microbes release Zn as they decompose root exudates such as H^+, HCO_3^-, CO_2^-, OH^- or organic compounds helped increasing the solubility of Zn.

12. Plant species and varieties: Zn deficiency are more common in fruit crops. Corns and beans are most sensitive to Zn deficiency. Potatoes, tomatoes, onion, sugar beet etc are moderately sensitive to Zn.

13. Restricted root zones: Zn availability is low in soils with restricted root zones. This may be

hampered by high water table or by the use of heavy machineries. e.g. Tractor.

14. Zn fertilizer:

- $ZnSO_4$. H_2O (36 % Zn).
- Zn EDTA (Zn-chillet).
- ZnO (78 % Zn).
- Zn-oxy-sulphate (ZnO. $ZnSO_4$)- 53 % Zn.

Factors affecting B availability

1. Soil texture: Sandy soil generally low in B content, clay soil retain the added B.

3. Soil pH: It strongly influences B availability in soil.

4. Liming: It is noted that heavy liming does not always lead to greater B adsorption & reduce plant uptake. Higher pH resulting from liming of soils high in organic matter may encourage OM decomposition and release of B.

5. Organic matter: Organic matter is one of the main sources of B in acids soils. Application of organic matter to soils can increase the B conc. in plants.

6. Depth of soils: The grater availability of B in surface soils compared with sub-surface soils. Interaction with other elements the occurrence of free Ca^{++}.

7. Interaction with other elements: B deficiency in plants may be aggregated by K suppliments to soil. N application might be useful in controlling excess B in plants. The antagonistic relationship between B-Ca, B-Mg, B-Mn, B-Cu, B-Zn (ZnO) and synergistic relationship with B-N, B-P, B-K.

8. Soil moisture and rainfall.

9. Cultural practices.

10. Plant factors: Relative sensitivity of selective crops-

High sensitive crops: Rice, Jute, mustard, groundnut, okra, amaranth, papaya, banana, brinjal.

Medium sensitive crops: Apple, Brokoli, cabbage, carrot, cotton, lettuce, radish, spinach, tomatoes etc.

Low sensitive crops: Cucumber, Onion, corn, bean, barley, pea, potato, rye, sorghum, soybean, sweet corn, wheat, garlic etc.